

REMARKS

Independent Claims 1, 6 and 21 and its dependent claims 2-5, 7-20 and 22-25 have been rejected under 35 U.S.C. 103 as being unpatentable over U.S. Patent No. 6,641,663 to Kemmochi et al. (hereinafter “Kemmochi”), in combination with U.S. Patent No. 6,136,092 to Sato et al. (hereinafter “Sato”), and U.S. Published Application No. 2002/192309 to Ohama et al. (hereinafter “Ohama”).

Claim 1

Independent claim 1 as amended recites a quartz glass crucible that has an opaque outer layer formed by melting natural silica powder and a first transparent layer formed on an inside thereof. The first transparent layer is made of natural quartz glass and has a thickness of 0.4 to 5.0 mm. A second transparent layer made of synthetic quartz glass is formed over only a part of the inner surface of the crucible, and that part includes at least an inside region of the crucible that extends from 0.15 L to 0.55 L from a center of a bottom of an inner surface of the quartz glass crucible. L is a distance from the center of the bottom of the inner surface of the quartz glass crucible to an upper end face of the quartz glass crucible adjacent the inner surface of the crucible.

This invention efficiently solves the problem of prior art crucibles, in which the transparent inner layer of the crucible peels off or warps, resulting in decreased productivity due to vibration on the surface of the melt. See Specification as filed, Page 4, Lines 23-25, and Page 5, lines 1-13.

The quartz glass crucible of claim 1 as amended is not suggested by any of the cited prior art, and reconsideration of the rejection thereof is respectfully requested.

Kemmochi discloses a silica crucible with a wall having an outer layer of natural silica glass, a first inner layer of transparent natural quartz glass, and a second inner layer of synthetic quartz glass covering the entire inner surface of the crucible. See Kemmochi, Col. 3, Lines 20-45. Kemmochi does not disclose or suggest a crucible having a layer of synthetic quartz glass extending over only a part of the wall, as recited in amended claim 1. The crucible of Kemmochi is therefore more costly to manufacture than the crucible of claim 1.

Sato teaches a crucible having an outer layer of opaque silica glass and an inner layer of transparent silica glass extending over the entire inner surface of the crucible wall. See Sato, Col. 3, lines 30-40. Sato also does not teach a crucible having a transparent layer of synthetic quartz glass that extends only over a part of the inside of the crucible.

Ohama teaches a three-layered quartz glass crucible with a translucent outer layer of natural quartz glass, a translucent intermediate layer of synthetic quartz glass, and a transparent inner layer of synthetic quartz glass, all of which extend over the entire inner surface of the crucible wall. See Ohama, Paragraph 13. Ohama also does not teach a second transparent layer of synthetic quartz glass that only extends over a part of the inside of the crucible.

The crucible of Claim 1 is therefore not suggested by any of the cited references.

Claims 2-5, 7-14, 16-20, and 23 depend either directly or indirectly from independent Claim 1, and therefore distinguish therewith over the prior art.

Claim 6

Amended claim 6 recites a method for producing a quartz glass crucible for pulling up a silicon single crystal, in which an inner cavity of a quartz glass crucible base body mounted on a rotatable mold in a high temperature atmosphere is made. Natural silica powder is fed to the high temperature atmosphere in an inner cavity of an opaque outer layer after or during the formation of the opaque outer layer. The inner cavity is partially melted to form a first transparent layer of natural quartz glass on an entire inner surface of the opaque outer layer by melting and vitrifying the natural silica powder. A synthetic silica powder is fed and the synthetic silica powder is melted and vitrified to form a second transparent layer of synthetic quartz glass on only a part of an inside surface of the first transparent layer of natural quartz glass, including at least a region extending from 0.15 L to 0.55 L, from a center of a bottom of an inner surface of the crucible. L is a distance from the center of the bottom of the inside surface of the quartz glass crucible to an upper end face adjacent the inside surface of the crucible.

For reasons similar to those expressed in regard to claim 1, the references cited do not show or suggest the method of amended claim 6. Specifically, no reference suggests a transparent layer of synthetic quartz glass that is on only a part of the inner surface of the crucible.

Claim 21

Amended claim 21 recites a quartz glass crucible for pulling up a silicon single crystal. The crucible has an opaque outer layer formed by melting natural silica powder and having an inward facing surface facing toward an interior space of the crucible and a first transparent layer formed on the inward facing surface of the opaque outer layer. The first transparent layer is of natural quartz glass and has a thickness of 0.4 to 5.0 mm. The first transparent layer has an inward facing surface facing toward the interior space of the crucible. The crucible also has a second transparent layer of synthetic quartz glass formed over only a portion of the inward facing surface of the first transparent layer. The second transparent layer constitutes only part of an inner surface of the quartz glass crucible facing the interior space thereof. The portion of the first transparent layer over which the second transparent layer is formed extends over at least an area extending from between two distances along the inner surface from a center of a bottom of the inner surface of the quartz glass crucible. One of said distances is 0.15 times a total distance along the inner surface from the center of the bottom of the crucible to an upper end of the inner surface of the crucible. The other of said distances is 0.55 times the total distance to the upper end of the inner surface of the crucible.

The structure recited in independent claim 21 is also not suggested by these references. No cited reference suggests a crucible having a transparent layer of synthetic quartz glass that only extends over only a part of the inner surface of the crucible.

Therefore, for reasons similar to those expressed in regard to claim 1, the references cited do not show or suggest the crucible of independent claim 21.

Claims 22 and 24-25 depend directly from Independent Claim 21, and therefore distinguish therewith over the prior art.

New Claim 26

New independent claim 26 has been added, together with dependent claims 27-28, to express another aspect of the invention disclosed herein.

Claim 26 recites a quartz glass crucible for pulling up a silicon single crystal. The quartz glass crucible includes an opaque outer layer formed by melting natural silica powder and a first transparent layer formed on an inside thereof. The first transparent layer is of natural quartz glass and has a thickness of 0.4 to 5.0 mm. A second transparent layer is formed over an inner surface of the crucible, and has a varying thickness. From a center of a bottom of the inner surface of the quartz glass crucible to 0.55 L therefrom, the thickness of the second layer is 0.3 mm or greater. From 0.6 L to 1.0 L from the center of the bottom of the crucible, the thickness of the second layer is 0.2 mm or less, where L is a distance measured adjacent the inner surface of the crucible from the center of the bottom of the inner surface of the quartz glass crucible to an upper end face of the quartz glass crucible.

New claim 26 is also not suggested by the cited references.

All of the cited references disclose only crucibles having continuous inner layers of uniform thickness. See Kemmochi, Col. 3, lines 30-34, lines 50-60 and Figure 1; Sato, Col. 3, lines 56-67 and Figs. 1 and 3; Ohama, Page 5, Paragraphs 50 and 52. These crucibles would either have the inner layer too thin in the area of the melt, or would increase expense by a thicker transparent layer in the upper part of the crucible.

Claim 27 and 28 depend from claim 26 and therefore distinguish over these references as well.

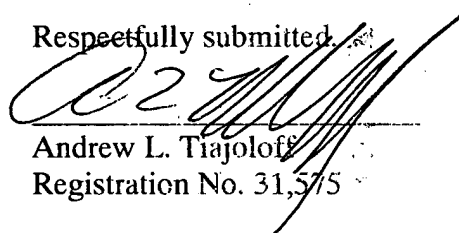
All claims having been shown to distinguish over the prior art in structure, function and result, formal allowance is respectfully requested.

Should any questions arise, the Patent Office is invited to telephone attorney for applicants at 212-490-3285.

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Respectfully submitted,



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